HISTORY AND DEVELOPMENT OF THE SEWERAGE SYSTEM OF BALTIMORE UP TO 1916

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SUMMARY OF THESIS

Little is known about the sewerage system of Baltimore prior to 1905 except the fact that it consisted of cesspools, private drains and few scattered storm-water drains. Several commissions appointed between 1862 and 1899 investigated and reported on imprevements to the sewerage system of Baltimore but little material progress made.

The real sewerage system of Baltimore dates back to the formation of the Baltimore Sewerage Commission in 1905. The commission authorized by the Sewerage-Enabling Act of 1904 served until 1916. During this period of time practically the entire city, as it existed prior to the annexation, had been properly sewered, a sewerage treatment works at Back River built, a sewerage pumping station constructed, Jones Falls covered from Baltimore Street to Preston Street with a highway built over it, and the storm-water drainage system greatly extended and improved. The work of the Baltimore Sewerage Commission was financed by three bond issues totaling $23,000,000.

EARLY HISTORY

As the founders of Baltimore came from England, it was natural for them to adopt the method used in England for disposing of human wastes, that of using cesspools. The sandy soil of Baltimore was suited for the use of cesspools, and the pit when first dug of reasonable size and depth will under favorable circumstances, serve its purpose for a long time without causing trouble or expense. As the houses were scattered when Baltimore was young, it was simple to replace a cesspool that had filled up by a new one, but as the population increased and houses were built close together, it was not easy to find a new site for a cesspool when the old one filled up. Also the introduction of the Gunpowder water in 1881 provided a liberal supply of water for water closets. Increased use of water-closets was necessarily followed by more rapid filling up of cesspools and property holders were glad to avail themselves of access to storm drains for the purpose of getting rid of the overflow of cesspools. Where storm-water drains were not available, permission was readily granted to construct private drains to the nearest water course. Though private drains were expensive and only corporations or persons of wealth could afford them, by 1905 there were 15,000 private drains in use.

When pits became filled to the top resort was had to the night-soil scavenger who cleaned the pit more or less thoroughly carting the contents to spots authorized by the Board of Health. There they were loaded on scows, removed to some

locality beyond the city limits and sold to farmers for fertilizing purposes.

The early city of Baltimore had a topography such that the extensive water front, the ravines and streams could provide adequate drainage. But with the expansion of the city and the filling in of ravines leaving arched flat-bottomed openings at the bottom of some of the ravines, soon found Baltimore without adequate drainage. Rocks washed from the surface collected on the flat bottoms and formed traps for silt, dirt and wastes which were allowed to flow down the open street gutters. The accumulation of rock, dirt and wastes decreased the size of the opening and during summer months the stench from the sewers was very objectionable. During heavy rains the sewers were unable to drain the storm water fast enough, and in places where there were no sewers, and they were many as sewers were few and far apart, the water flowed down along the surface of the streets. The water flowing along the surface would tend to accumulate in hollows and depressions causing injury to property and loss of life. To relieve the existing sewers of their burden during storms and to provide sewers in places where there were no sewers, by 1887 the city had expended $4,000,000 in construction of 33 miles of drains but that was insufficient.

Considering five persons to a private drain, it would mean that 75,000 persons disposed of their wastes in the Patapsco River Basin. Engineers on the other hand estimated that the

Patapsco River could only dispose of the sewerage by dilution of a city of a population of 37,000. Added to the waste from the private drains must be added the wastes brought down by the storm-water drains. With more sewerage being poured into the Basin and Jones Falls than the Patapsco River could dispose of, the Basin became a gigantic cesspool with the odor being noticeable for miles around. Records show that with the wind in the right direction, the odor was objectionable 9 miles away in Towson.

THE BALTIMORE SEWERAGE COMMISSION

It seems strange that Baltimore should have delayed so long in providing a modern sewerage system, but the sandy soil of Baltimore was well suited for cesspools and many felt that as long as the cesspools were economically justifiable there was no need for a modern sewerage system. Baltimore also showed little progressive spirit. But it was not alone internal forces but external forces that delayed a sewerage system. As the State Constitution provided that it was necessary for the State Legislature to authorize a loan for any sewerage improvements, and as the majority of the members were from the counties there was little hope for an authorization of a loan without great demand from Baltimore City. The counties bordering on the Chesapeake Bay viewed with great concern any project to build a sewerage system discharging sewerage into the Chesapeake Bay and thus menacing the oyster industry.

The condition of the Basin had aroused many people and now with the Great Fire of February, 1904 to awaken them, the people of Baltimore demanded that a modern sewerage system be put in while reconstruction was going on in the city. On April 7, 1904, the General Assembly of Maryland passed the Sewerage-Enabling Act, enpowering the Mayor and City Council of Baltimore to issue stock to an amount not exceeding $10,000,000 for the purpose of defraying the cost of establishing a sewerage system for Baltimore. The act authorized the Mayor to appoint a commission of seven men with the Mayor to be a member ex-officio. The commission as then to appoint a Chief Engineer.

The commission had full authority over the building of the sewerage system but no power to make purchases or award contracts exceeding $500, to decide matters of a legal nature or to determine the amount of money to be spent annually. The counties to safe-guard the oyster industry had included in the act a provision specifying that no sewerage or sewerage effluent was to be discharged into the waters of the Chesapeake Bay that could in any way contaminate or harm the oysters.

The Baltimore Sewerage Commission originally consisted of:

Peter Leary, Jr., Chairman
Hon. E. Clay Timanus, Mayor
Ira Remsen
William D. Platt
Morris Whitridge
Charles England
J. Edward Mohler
Harry W. Roger, Secretary

Calvin W. Hendrick was selected as Chief Engineer. The commission was in existence from 1905-1916 and during that period there were several changes in the membership. In 1911 Charles England succeeded Peter Leary, Jr. as Chairman upon Mr. Leary's death February 13, 1911. William W. McIntire was appointed to fill the facancy in the commission. However, Mr. McIntire died March 3, 1912 and was succeeded by William B. Kines. J. Edward Mohler died August 6, 1912; Gustav

Siegmund receiving the appointment to his position. William D. Platt died December 23, 1913 and Thomas J. Shryock was appointed to the vacancy.

SEWERAGE DISPOSAL PLANT

As the commission could not discharge the sewerage directly into the Chesapeake Bay, it had to have a sewerage treatment plant built. There were three methods considered:

(1) That of Intermittent Filtration through natural sand beds in Anne Arundel County.

(2) That of Intermittent Filtration through artificially constructed sand beds of select sand.

(3) That of preliminary treatment in Septic Tanks, followed by sprinkling over filter beds of broken stone with a final purification by intermittent filtration through artificial sand filters.

After conducting many experimental tests upon the soil of Anne Arundel County, the soil was found to be unsuited for filtration purposes, as it contained clay matter. That necessitated the abandonment of the first plan.

It was next decided to see if artificial sand beds could be used. The sand necessary for this method was estimated at 7,000,000 cubic yards. Examination of all suitable sand beds in the locality revealed the fact that there were 4,700,000 cubic yards of sand available. As it would be too expensive to import sand that plan had to be dropped.

After much deliberation, the system selected consisted of treatment in septic tanks followed by sprinkling over filter beds of broken stone, with a final purification by intermittend filtration through artificial sand filters. To test the system, an experimental station was built in Walbrook consisting of a testing plant, a laboratory, and sewers at a cost of $44,000. The results indicated that the intermittent sand filter beds could be eliminated from the system this saving over $2,000,000 in original construction and upkeep. The sewerage would now pass through three steps of the purification process, the septic tank, sprinkling filters and settling basins.

The site selected for the plant was Back River. As estimates showed that to sewer and drain the city in accordance with the Sewerage-Enabling Act would require over twice the amount then authorized and as it was not certain that sufficient money would be forthcoming later on, it was deemed advisable to build the Disposal Plant in units. Thus in case work had to stop due to lack of money there would be a complete workable plant capable of serving about half the population of the city.

The plant was begun in 1907 and by October, 1911 the first purification of sewerage was performed. By the end of 1911 when the first $10,000,000 had all been expended, the plant was capable of purifying the sewerage from 275,000

persons. By 1916 the plant had been expanded until it had a capacity of 600,000 persons. Construction on the plant is expected to continue until the sewerage disposal plant has a capacity of 1,000,000.

OUTFALL SEWER

The Outfall Sewer extends from Chase and Durham Streets to the Sewerage Disposal Plant at Back River. Work on the Outfall Sewer was started December 27, 1906 and completed on August 1, 1909 at a cost of $1,280,621.53. The sewer is of the horseshow type being built of concrete, the lower half being lined with brick. From Chase and Durham Streets to Madison and Luzerne Streets, a distance of 3,879.21 feet, the sewer is 10 feet 9 inches high and 12 feet wide; thence to the Disposal Plant, a distance of 26,351.80 feet, it is 11 feet high and 12 feet 3 inches wide. The Outfall Sewer is a gravity sewer with the flow from the High Level Interceptors entering by gravity while the flow from the Low Level Interceptors is pumped up to the Outfall Sewer from the Pumping Station a height of 72 feet.

SEWERAGE SYSTEM

As the sewerage had to undergo treatment before being discharged into the Bay, the separate system was the only possible one. In the separate system the sewerage system is independent of the drainage system. If both the sewerage and the storm-water had been allowed to pass into

the same system the cost of purification and the size of the disposal plant, the Outfall Sewer and the Pumping Station would have made the system too expensive.

The sewerage system consists of a number of High Level and Low Level Interceptors with many lateral sewers. From the lateral sewers are run house connections. The interceptors are circular in shape having a layer of hard brick with layers of water-proofing between the brick and concrete with a sub-drain beneath. A minimum diameter of eight inches was adopted for the laterals with connections running to property line fixed at six inches as minimum. In residence districts the laterals are deep enough below the ground to drain the average basement and in the business section to drain basements 13.5 feet deep. The sewerage system was started October 22, 1906 and the first house (1701 Jefferson Street) was connected and caring for the sanitary sewerage of the city begun. By the end of 1916 there were 83,053 houses connected.

STORM-WATER DRAINAGE

Unlike the sewerage system which had to wait until the Sewerage Disposal Plant and the Outfall Sewer was completed, the drains were put into service soon after work began. Although not as much money was expended on the drains at first as they were not considered as necessary as the sewerage system, yet by the end of 1914 most of the city was

adequately equipped with drains. The size of the smallest drain 6 inch cast iron pipe, while the largest was a horseshoe drain 96 inches by 93 inches. The drains discharge into Jones Falls, Gwynns Falls and the Basin and are built to handle a rain at the rate of 4 inches per hour.

SEWERAGE PUMPING STATION

Construction on the station was started in 1907 and the station put into operation January 31, 1912. The station is located at Eastern Avenue and President Street. The sewerage from two Low Level Interceptors flows to the station. The West Low Level Interceptor is 84 inches in diameter and the East Low Level Interceptor is 60 inches in diameter. Both interceptors enter the station at 13 feet below mean low-tide. The pumping station is equipped with three verticle triple expansion pumping engines. Each engine has a rated capacity for pumping 27.5 million gallons per day of sewerage against a total head of 72 feet when operating at 20 R.P.M. Space is left so that two additional pumps of similar size can be installed.

JONES FALLS

The open Jones Falls had long been an eye sore and when an additional $10,000,000 was turned over for a sewerage system in 1911, one of the first projects considered was Jones Falls. Jones Falls was enclosed in conduits from Baltimore to Chase Streets. From Chase to Preston Streets a tunnel was dug across a bend in the river. Over the conduits

was constructed a low grade street. The conduits had a capacity of 15,000 gallons per second and the work was completed by 1914.

METHOD OF TREATMENT OF SEWERAGE

The sewer goes from the houses through the house connections into lateral sewers by gravity. The lateral sewer discharges into larger sewers called interceptors; in the interceptors, if it is a high level interceptor, the sewerage flows by gravity to the Outfall Sewer. If the interceptor is a low level interceptor the sewerage flows by gravity to the Sewerage Pumping Station. At the Pumping Station it is lifted 72 feet through force mains into the Outfall Sewer. In the Outfall Sewer it flows a distance of near 6 miles to the Sewerage Disposal Plant all flow taking place by gravity.

At the mouth of the Outfall Sewer are installed screens which catch such things as sticks, rags, etc., which are removed by hand and burned. The sewerage then passes through the Meter-house where the flow is measured, then into settling tanks. It remains in the settling tanks for a period of from two to eight hours depending on the rate of flow of the sewerage. The liquid now passes on to an intercepting channel to revolving screens of a 20 mesh where more of the suspended solids are removed. From the revolving screens house it passes to the control house which distributes it to the sprinklers in the trickling filters located at a level 15 feet below the settling tanks. The flow is so regulated that the size of the spray increases and decreases periodically.

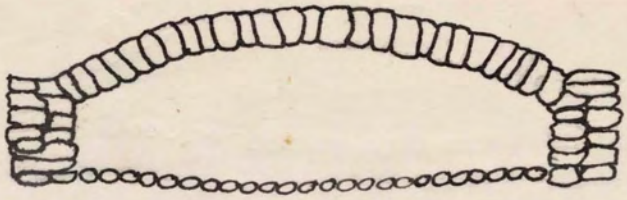
Spraying of the sewerage through the air is essential

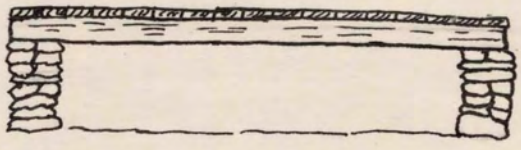
to the aeration and purification of the sewerage. As the sewerage falls on these beds it trickles down through 8.5 feet of broken stone varying in size from 1 inch to 2.5 inches. The passing of the sererage through these beds forms a gelatine-like film on the stones in which certain bacteria multiply by the millions attacking and killing the injurious bacteria in the sewerage. The sewerage effluent on reaching the bottom of these stone beds is practically pure. It is then carried by drains to the settling tanks for the purpose of settling out certain mineral substances. The sewerage effluent then passes through a powerhouse where a drop of 18 feet is used to operate turbines. Electricity generated by those turbines is used to light the plant, run sludge pumps, and lift clarified sewerage to a water tower for flushing purposes. From the powerhouse the effluent flows down to Back River. The sludge which deposits out of the sewerage is pumped into separate digestion tanks. After remaining in the tanks long enough to digest, it is drawn off into sand beds to drain. The sludge is quickly reduced by evaporation and filtration and the resulting nearly dry humus and mineral matter is inodorous and inoffensive. The sludge is then given free of charge to farmers who use it as a fertilizer preparatory to planting.

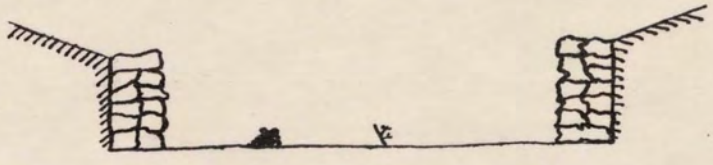
The information for this thesis was obtained from the following sources:

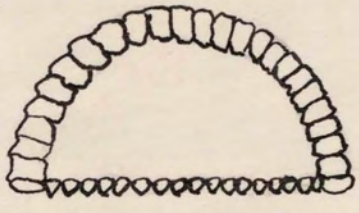
1. Report of the Baltimore Sewerage Commission--1862
2. Report of the Baltimore Sewerage Commission--1897
3. Second Report of the Baltimore Sewerage Commission--1899
4. Sewerage-Enabling Act of 1904--Chapter 349
5. Nine Annual Reports of the Sewerage Commission of Baltimore--1906-1914
6. Reprint of Articles Pertaining to Sewerage System of Baltimore City--Issued by the Bureau of Sewers--1927
7. Tour of the Back River Sewerage Disposal Plant and an interview with Mr. Cromwell, one of the chemists at the plant.

SEWERS BEFORE 1862



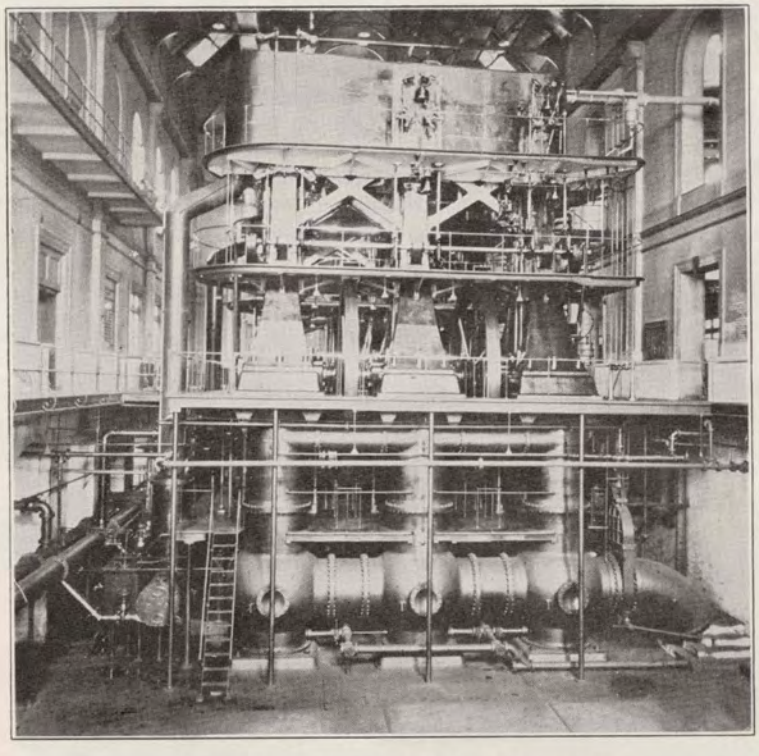






Scale 1" = 8'

EXTERIOR VIEW OF SEWAGE PUMPING STATION



INTERIOR OF PUMP AND ENGINE ROOM

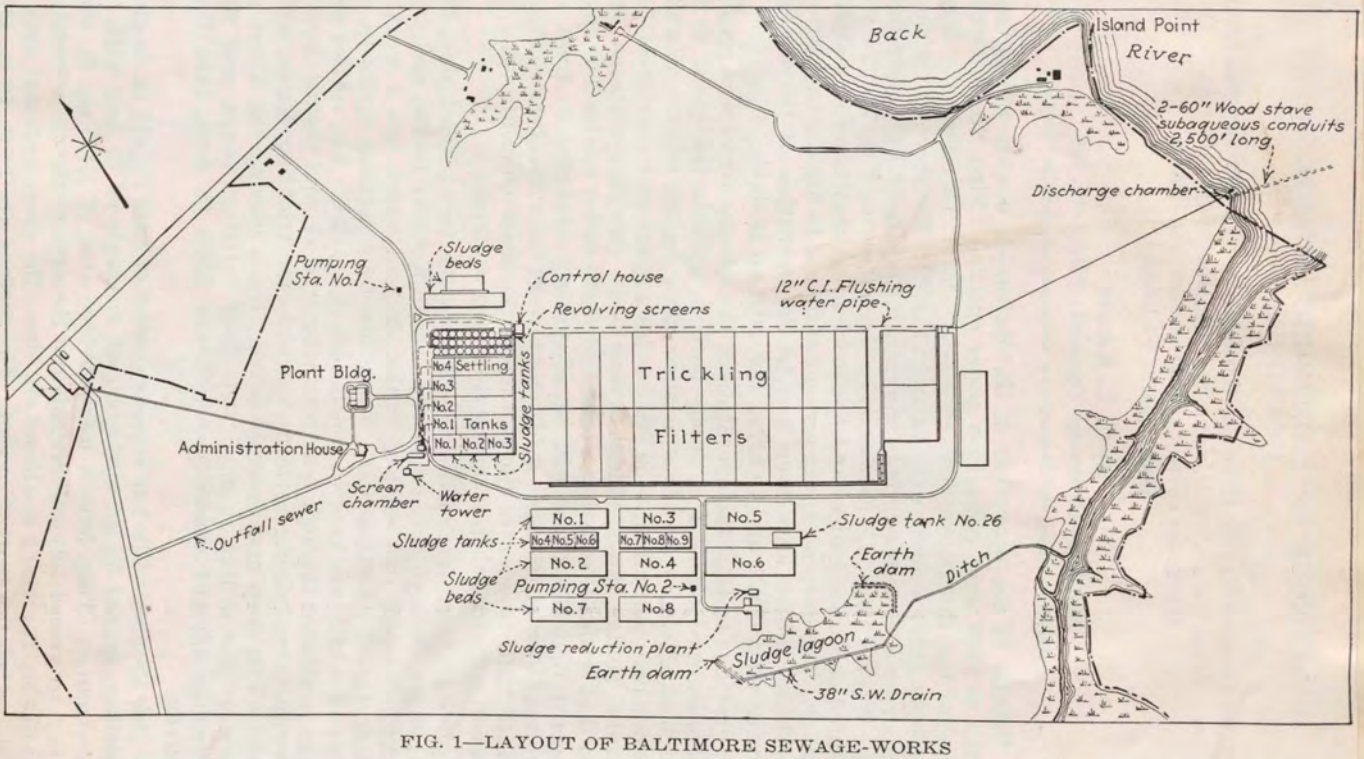


FIG. 1—LAYOUT OF BALTIMORE SEWAGE-WORKS

BALTIMORE SLUDGE-DRYING BEDS READY FOR USE

FIG. 2—BACK RIVER TREATMENT WORKS. SLUDGE DIGESTION TANK, No. 1. BEGINNING TO GASIFY.

FIG. 3—BACK RIVER TREATMENT WORKS. SLUDGE TANK No. 1. SHOWING GASIFICATION OVER ENTIRE TANK.

BACK RIVER SEWERAGE DISPOSAL PLANT

Sprinkling Filters, Sludge Beds, & Sludge Tanks

Sludge Tanks and Sludge Beds